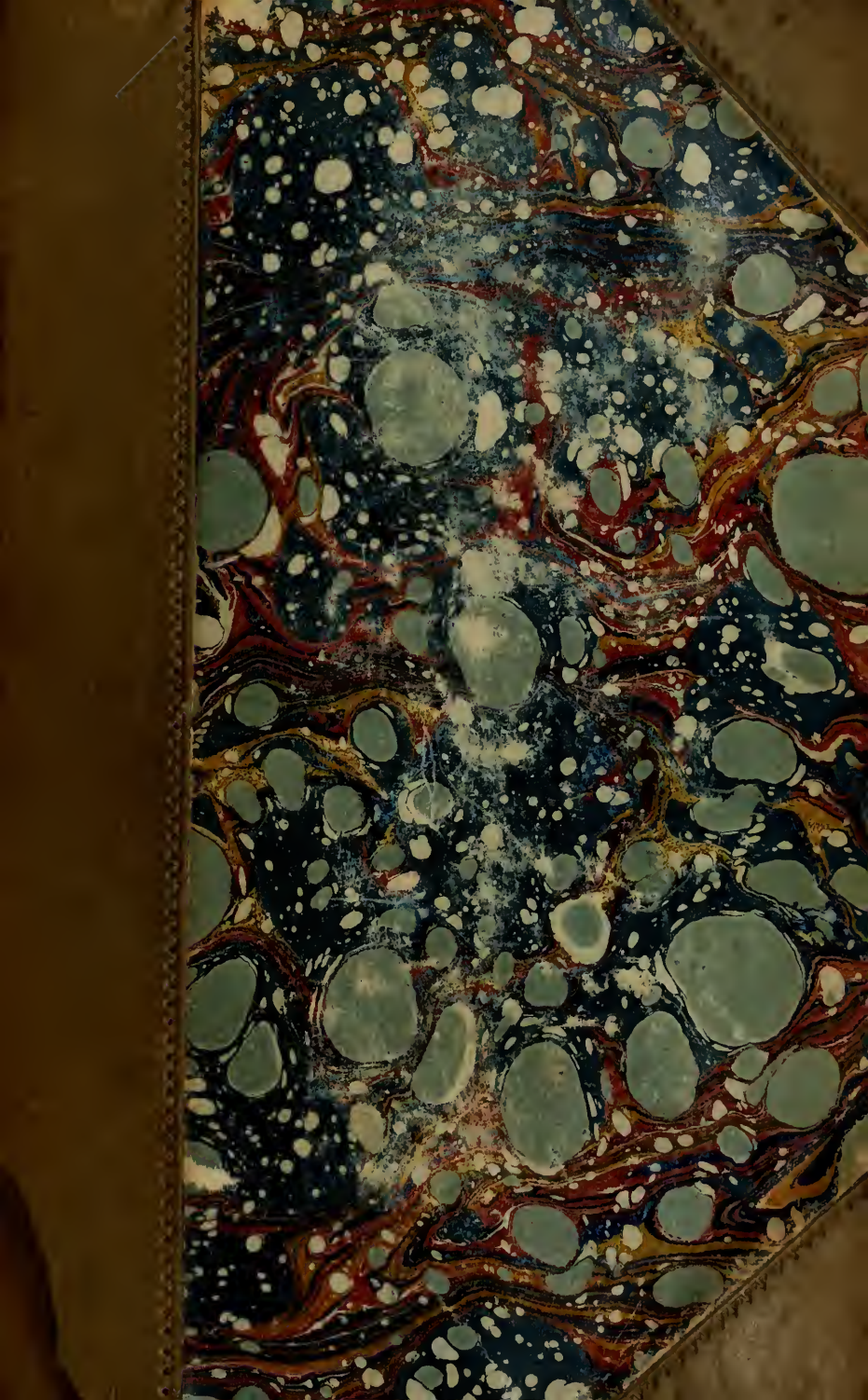


A VOICE FROM THE SIGNAL-BOX:

OR,

RAILWAY ACCIDENTS AND THEIR CAUSES.

BY

A SIGNALMAN.

LONDON:
LONGMANS, GREEN, AND CO.
1874.

Price One Shilling.

LONDON:
PRINTED BY BEVERIDGE & CO.,
HOLBORN STEAM PRINTING WORKS,
9 TO 12, FULLWOOD'S RENTS.

INTRODUCTION.

TO M. T. BASS, Esq., M.P.

March 2nd, 1874.

Sir,

Having carefully perused the MSS. written by a signalman on the causes and remedies of railway accidents, which you did me the honour to place in my hands some days ago, I beg to report that they contain particulars of many startling defects in our railway system which have not hitherto (so far as I am aware) been brought under public notice. A very natural impression prevails amongst the public that railway travelling is very unsafe, owing to the frequency and terrible destructiveness of accidents during the past twelve months. The remarks of this pointsman show that it is a marvel that so few casualties occur on our busy lines, and that sooner or later we may confidently expect a series of disasters unparalleled in the history of railways. I have no

hesitation in saying, therefore, that if published, the book would be of great use in directing general attention to this important subject. It undoubtedly throws a flood of light upon the causes of railway catastrophes of all kinds.

I have found it desirable to cut out many portions of the original MSS., some of which were irrelevant, and others repeated in different parts of the work, but the construction of the sentences has not been altered, except in cases where the meaning was somewhat obscure.

The writer commences by stating that he has had many years experience as a signalman at one of the most frequented and complicated junctions to be found in this country. His hours of duty, as a rule, are eight per diem, during which period he is required to move levers sixteen hundred times, and give two thousand signals by telegraph.

He shows that, notwithstanding the important part played by signals in the working of railways, the signalman is frequently very imperfectly instructed in their use. This official has often to learn his duties as best he can from his predecessor. He goes through a theoretical examination at the office of the Superintendent of the Line, it is true, but this does not in any way test his practical ability to perform the duties. Such a practice must necessarily be fraught with the greatest danger to railway passengers. The

The Rare Book & Manuscript Library UIUC

block system, the interlocking apparatus, or any other signalling arrangement calculated to ensure safety, is worse than useless in the hands of untrained men, and not unfrequently becomes, in fact, under those circumstances, an instrument of destruction. The writer remarks that the superintendent or inspector who examines signalmen previous to their taking charge of a box, is seldom practically acquainted with the manipulation of signals, and in a difficulty an officer of this class will occasionally appeal to the signalmen to know "what is the usual practice in such cases!" He recommends that experienced signal-workers be appointed to superintend the training of all new hands.

He points out that at present there is no means of preventing engine-drivers, who have been standing with their trains in branches or sidings, from running on to the main line while the signals are against them, to the destruction of some passing train, and states that by introducing into all such sidings and branches, safety points interlocked with the signals, so as to turn away, on to a separate line, with a dead stop-block at the end, any train which attempted a movement of this kind, accidents from the cause named could be entirely done away with. A serious collision of this nature, it may be remarked, occurred a short time ago on the Great Northern Railway at Boston.

He comments on the utter inadequacy of the present arrangements for signalling from sidings (situated at a distance from the signal-box) to the signalman on duty. A gong is generally used (as at West Drayton, where a most serious accident took place some weeks ago), and the man at the cabin having many signals and levers to attend to, may easily forget what number of beats has been given, and allow a train to rush forward when the line is blocked. To remedy this defect he suggests that an indicator be substituted for the gong to show continuously "line blocked" or "line clear," as the case may be, and that this instrument be worked from the sidings by a lever which should always be kept locked over. The last of these recommendations, I may observe, has also been made by the Government Inspector, Captain Tyler, who inquired into the cause of the West Drayton collision.

He states that sufficient attention is not paid by railway authorities to suggestions for the improved working of signals and points made by signalmen, and gives two cases where he himself pointed out serious irregularities with no better effect; the consequences being that in one case an accident occurred shortly afterwards, and in the other a disastrous collision was providentially averted. Since then the alterations he ventured to suggest have been made.

He complains loudly of the system practised by the railway companies, of harassing their signalmen with letters of inquiry respecting paltry delays to trains at busy junctions. This, he emphatically asserts, is productive of many accidents by causing the men to be too anxious to get trains past their boxes without detention. For they often allow trains to follow each other with too short an interval of space between; or permit two trains to cross a junction almost simultaneously, to the destruction of one or other of them. The collisions near Bolton on the Lancashire and Yorkshire line in December last, occurred under circumstances similar to those above described.

He states that signalmen are wretchedly underpaid; that promotion is invariably denied them; and that their occupation is calculated to "impair the strongest of minds, and make them careworn and melancholy."

He calls attention to the fact that in foggy weather signals fixed at a considerable distance from the ground are of no use whatever, because the enginemen of many express trains are obliged to rush by them without noticing whether they are on or off. To remove this shortcoming he considers it desirable that a second signal arm and lamp should be fixed on each post about the height of the driver on his engine. There would then be no difficulty whatever

in the way of his ascertaining the state of the signals in the densest and gloomiest of fogs.

He explains that the breakage of springs, axles, and tyres of vehicles is a prolific source of danger. These fittings are often fractured by violent shunting rendered necessary by insufficient siding accommodation, and they usually break when running at great speed over bad joints in the rails.

He thinks that a passenger train should not be allowed to run at a greater speed than 40 miles an hour ; that it should not consist of more than fifteen vehicles, and that there should be one guard to every five carriages. At present passenger trains are frequently delayed at stations through the guards having too much work to do, thus causing unpunctuality, which, as has often been pointed out, is a primary source of disaster.

He bears testimony to the dangerous nature of the shunter's occupation, and shows that although the companies profess to forbid "fly-shunting," or uncoupling wagons in motion, it would be impossible in the present state of the railway system for the work to be got through in any other way.

Goods trains are usually too long and too heavy, he says, for the guards and break-power sent with them ; and delays under these circumstances are of course inevitable. The coupling chains of wagons,

moreover, frequently become fractured when the trains of which they form part are started and afterwards snap completely asunder whilst they are proceeding on their journey. In this way a number of vehicles often break loose, and remain on the line to be run into by the following train.

With regard to the hours of labour of railway servants, he recommends that enginemen, and passenger and goods guards be not allowed to remain on duty longer than ten hours per diem; also that pointsmen, signalmen, and shunter's hours be limited to eight per diem. All other classes of railway employes he considers may safely be kept on duty ten hours daily. He suggests that relief men be kept at certain stations, so that in cases where trains have been much delayed, the officials in charge thereof may be relieved as soon as they have completed their full term of duty, instead of, as at present, being compelled to work forward to their journey's end, regardless of the length of time it may occupy.

In concluding my brief remarks on, and summary of, this interesting work, I would observe that many of the suggested improvements referred to above, have been also recommended at various times by other railway officials of long experience, and being fully convinced of their utility, I have taken occasion

to comment upon them in a lengthy article on the "Internal Working of Railways," published in the current number of the *Fortnightly Review*.

I have the honour to subscribe myself,

Your obedient Servant,

EDWIN PHILLIPS,

Editor of "The Railway Service Gazette."

14, CARLISLE TERRACE,
STRATFORD, ESSEX.

A VOICE FROM THE SIGNAL BOX;

OR, RAILWAY ACCIDENTS AND THEIR CAUSES.

My experience has clearly taught me that our Railway system is at present very defective, and it is with a view of bringing into prominence the causes thereof that I venture to pen the following lines. I have had eleven years experience as a signalman upon one of our chief railways, and the greater part of that time at one of the most frequented and complicated junctions to be found in this country, situated within a hundred miles of St. Paul's. My hours of duty are eight per day all the year round. Nearly five hundred trains pass my box in twenty-four hours, requiring the moving of four thousand eight hundred levers, and six thousand signals to be given on the block telegraph. If these are divided into three parts, it will be seen that I and my mates have each sixteen hundred levers to shift, and two thousand signals to give daily on the telegraph during the time we are on duty. This refers to *ordinary times.* In the busy seasons of the year, our work is increased by about one-fourth, and upon extraordinary occasions it is nearly doubled. I will deal first with—

Accidents caused through the Insufficient Training of Signalmen.

On this Railway—I cannot speak for others—but, from what I have learnt from other companies' servants, I believe it is the same elsewhere—the signalman's training is very imperfect, considering his very responsible duties. In a few weeks, or it may be in a few months after joining the service,

he is sent to learn his future duties at a small station where the then signalman is, through some cause, about to leave or be removed. He may thus be placed at a very great disadvantage. Possibly, the man who teaches him has been called upon to resign through carelessness or inefficiency, and can it be expected, if he did not take any pains for his own benefit, that he will trouble himself for the benefit of others? The consequences are these:—

When the new beginner is asked the usual question by his superior, viz., "Are you able to undertake your duties?" he, for fear of being considered longer than others in learning, and, at the same time, hoping soon to get a small rise in his wages, will answer "Yes," although he may be very little better informed upon the principal points relative thereto than on the day that he first entered the signal-box. He departs from the head-office a signalman in name, and amid doubts and fears, takes to his new post with the fullest intention of doing his best, no doubt; but, alas! on account of his inefficiency, he may deal out death and destruction all around him. There are "careful" and attentive signalmen, and under the present system of teaching them their duties, the careless man is not found out until he has made some great blunder, and the careful man has often to suffer for the careless one. Suppose the man leaving be the careless one, and the man sent to take his place the careful one; perhaps the latter, with good and proper training, would be the right man in the right place; but he may learn from his predecessor to make the following mistakes:—Not properly to place signals at danger after a train has passed, thus allowing another train to follow too soon; to let shunting take place across the main line when fast express trains are due; to neglect to telegraph to the next station on the passing of a train; and other irregularities too numerous to mention. Possibly none of these things have been pointed out to him in a proper manner; he may, therefore, make a mistake, and be sent for to headquarters, and most likely dismissed from the company's service, his prospects being blighted for

some time to come, for no fault of his own whatever, as we have seen. On the other hand, suppose the man leaving be a good and useful signalman, going to better himself, and the man sent to learn the duties a careless man, who pays but little attention to what is told him : the former is quite ready to show him all he can, but yet he may plainly see that this new hand is not the proper sort of man to make a good and trustworthy signalman. His time comes to leave; he has done his duty, and he leaves his post in charge of his successor, pretty well convinced that without a slice or two of good luck the consequences will be disastrous. But this is no business of his; he is seldom asked any questions upon the subject, nor is it any part of his duty to make a report of what he knows to be the fact under the present system.

It is essential, therefore, that some good and experienced signalmen should be appointed to superintend the training of all new hands, remaining with them until they are able to give a favourable report to their superintendents, stating that the men thoroughly understand the responsible duties they are to perform.

Moreover, a signalman's pay should be commensurate with his responsibilities. At present it is not so by any means, and I can emphatically assert that the dissatisfaction and inattention thus caused is a source of great danger.

Accidents caused by Signalmen being Removed from a Level Box to an Elevated one without proper Training.

The same causes which operate in preventing signalmen from learning their duties in the first instance, lead to the following important faults in connection with their work when they are removed from a box level with the ground to an elevated one. They may learn which levers to pull over to let a train pass, but that is not all; the question is, when to pull them ; and when they have been pulled, to know whether the points have answered the movements of the levers. For

instance, when a pointsman is letting a train in or out of a siding by hand signal upon the ground, or attending to main line points, during shunting, he is generally upon the spot, and has, of course, the points close under his eye, so that he can at once see whether they are properly closed or not. Very different is it in the high box, for the points may be a hundred, or a hundred and fifty, yards away. Between the lever in the box and the points, there are five or six cranks and double as many pins to connect them together, so that allowing for the wear and tear, it is generally found that between the lever and the points there is a certain amount of "loose motion;" and this, combined with the weather, may greatly deceive the signalmen as to the position of the points. If you pull a lever to open distant points during the time it is raining, you will find that they move very easily; but if you do the same thing after a hot sun, a dry wind, or a frost, and put an equal amount of power on the lever, you will find that it is not over in its proper place by, perhaps, two or three inches. Now, the man newly appointed to the high box, who has not had proper instruction, after giving the lever the usual pull, and finding that it does not come properly over, will most likely press it into its appointed place by the weight of his body; which pressure will, perhaps, be great enough to tighten up the "loose motion" previously referred to, and will allow him to get the lever into its proper position without moving the points any more after giving them the first pull. They will, therefore, be standing far enough open to throw the next train off the rails that approaches them in that (facing) direction. The man who knows his work, when he finds that a lever does not come over properly at the first pull, will put it back again, and give it a much sharper pull than before. This will, without doubt, have the desired effect, and should be done in all cases before a signal is lowered for a train to pass through the points.

Accidents from the above cause are of daily occurrence, and they greatly impede the attainment of punctuality, and endanger the lives of the public.

Accidents caused through the imperfect Working of Distance Signals from the High Box.

These incidents are particularly frequent upon those lines where the "Disc" and "Cross Bar" signals are in use, as the leverage in the high box is much shorter than it is upon the ground, and the signalmen is apt to consider that so long as he has got the lever into its appointed place, and the spring into its proper groove or catch, after the passing of a train, that the signals are properly at danger; this is a great mistake.* With the "Cross Bar" system you have a much better purchase in pulling the signal round to show "all-right" than in pushing it back to "danger." In the former case you are assisted by the weight of the body, but in *pushing* the lever you have not this advantage, and if great care be not taken, in some weathers, the signal may be standing at "all-right," or nearly so, when it should be at "danger," the way in which the lever has been moved being just enough to tighten up the slack wire without moving the signal round. In this case the driver will be unable to pull up before reaching the home signal, and so an accident ensues. The experienced signalman in working these high boxes is generally able to tell by the travel of the wire, the strain he feels upon the lever, and the force he uses in putting it over to "danger," whether the signal has properly acted or not, as he is able to allow for the action of the weather upon the signals and points. The failure of signals to act properly in this way causes many accidents, and also much contradictory swearing between the engine-driver and the signalman. It is easy for the signalman to prove that the lever moving the signal was in its proper place, consequently, the engine-driver is blamed for running past it when it is supposed to be dead against him, whereas the very reverse may be the case. Inquiries into these matters should be taken in hand very

* I do not by any means wish it to be understood that I condemn those kinds of signals; but I think that more care should be used with them than with others; therefore the signalman who has to work them should be particularly well trained.

carefully, by men who thoroughly understand the practical parts connected therewith; and in the end they will not fail to trace the blame to its proper source; namely, to the unskilfulness of the signalman in not being able to tell, after moving his signal, whether it has acted properly or not.

I will name a case that occurred at the junction where I am doing duty.

I was in the act of pulling over a pair of junction points, when they became disconnected from the rod attached to the lever in my box, through the key coming out of the pin, and thus allowing it to gradually work out of the crank. Now this pair of points generally worked very easy, so that there was but the slightest difference in the strain upon the lever; still I detected a difference, and it was very fortunate I did, for I was putting the points right for a fast express to pass, which would otherwise have been thrown off the rails, as the fault did not in any way prevent my putting the signals to "all-right" for this purpose; and had I not discovered that something was wrong (as the box is worked upon the interlocking system) the result might have been something fearful. The experienced signalman is able to detect as slight a difference as two pounds in the force used to pull levers over, and men who can do this are, in my opinion, invaluable to Railway Companies.

Accidents caused by Engine-Drivers disregarding signals at Junctions, Points, or Sidings.

Engine-drivers sometimes disregard signals at junctions and sidings, if the latter are protected by signals alone, as there is nothing to prevent them running from the siding or branch on to the main line, perhaps into a passing train; and before railway travelling can be made safe, these dangerous sidings and junctions must be altered. They should be protected both by signals and "Protection" or "Safety Points," which should lead off into a dead end, blocked up with ballast, and interlocked with the main line signals. So that all the time the latter are standing at "all-right," for a train to pass

along the main line, the "safety points" would stand for the dead end; and should a train start from a siding against the signal, it would, to the driver's great surprise, run into the ballast "stop," thereby avoiding the danger of a collision. It would be much better to cause a shock to the branch train than hurl two trains to destruction. In cases where junctions are so constructed that there is no room for these "safety points" to be put in, a signal-box should be placed at some convenient distance from the junction; say a quarter of a mile. The branch train should be kept at it, under the block system of telegraph, until the signalman at the junction could admit it on to the main line. In the case of sidings, I see nothing to interfere with the "safety points" being used. They would make all junctions, sidings, and level crossings quite safe, and would be the means of making engine-drivers very careful to keep a good look out; for they would know that if they overran the points, they would run their trains into a "dead end." Thus would, at once and for ever, be done away with, one of the most fearful classes of railway accidents.*

Another important recommendation I have to make is, that some small instruments, known as "indicators," should be employed between sidings where shunting is done, or where goods trains are put by for fast express trains to pass, and the interior of high boxes that are far from them. A siding may be a hundred or a hundred and fifty yards from the signal-box. On a dark, and perhaps foggy night, the usual way of performing shunting at the present time is, for the signalman

* It would not necessarily follow that under the system here proposed a driver would run his train into the dead end if he overran the points (against the signal). I would advise that a crank be attached to the lower part of the signal post, with two arms, just long enough to reach the nearest rail, having claws at the ends with a fog signal in each claw. This crank should work with the signal, and when the latter was standing at danger, the fog signals (or detonators) would be resting on the rail. As soon as the signal was put to "all-right," the simultaneous action of the crank would withdraw them clear from the line. Thus the driver would always discover what he was about in time to have a chance of pulling up before reaching the dead end. These throw off lines should be made as long as circumstances would admit.

to depend upon the man in charge to show him a white light by hand lamp, or give a signal on a gong worked by electricity, when the main line is all clear for another train to pass. Now the former is a very dangerous system, for where shunting is taking place, the guards and the men in charge have each lights in their hands; there are also lights on the engine, and on the train which is being shunted. All these are moving about in different directions at the same time, and the signalman may easily take one of them as a signal that the line is clear before it is so. I have known many accidents to occur through misunderstandings under these circumstances. Moreover the gong is not always to be relied upon, for the signalman may forget what number of beats has been given.

To prevent such mistakes, a lever should be placed in a convenient spot as near to the points in the sidings as possible, and this should be attached to a small arm, or indicator, placed in the signal-box. It should be kept locked over by means of a padlock, so as to show the "all-right" signal (in the box) when no shunting is being done, the key being in charge of the signalman; when any shunting is required to be performed, he should hand it to the man in charge, who ought to be held responsible for locking the lever over to "danger" as soon as the shunting commences, and keep it so until everything is put back into the siding, and the main line all clear; then he should lock the indicator over to "all-right," which would show the signalman for certain that all was right. The indicator in the box should interlock with the main line signal lever, so that it would be quite impossible for the signalman to let a train pass in that direction during the time the former was at "danger." This simple suggestion could be carried out at a very trifling outlay, and would save thousands of pounds.

Warnings of Signalmen Disregarded.

The warnings of signalmen are, fortunately, too often disregarded by the officials. Some time ago I pointed out where

there was great danger of a collision occurring, but this (from a signalman) was thought of no importance, and was therefore not then attended to. Only a few weeks afterwards a collision did take place under the very circumstances that I had pointed out, and the company have since had to pay thousands of pounds for compensation; whereas, had my warning been attended to at once, such accident could not have occurred, as the protection I had asked for was very simple, but quite effective.

There was another dangerous point to which I called an official's attention, but, like the former, it was left too long without remedy; for a few nights afterwards (I was not on duty myself) it was only by a miracle that a collision was averted at the very spot; and as soon as it became known to the higher officials, it was at once seen that such an improvement as I had pointed out was urgently required. This has since been done, with very good results; but, to some extent, it puts me in mind of the old saying, "Locking the stable-door after the horse is stolen." I may here remark that men are sometimes appointed to the position of signal-inspectors who have never done one hour's duty in charge of a signal-box in their lives. Just fancy an official of this kind being entrusted with the very important duty of seeing that signal-men thoroughly understand all the important points connected with their duties that I have named! How is he to know whether those placed under his charge thoroughly understand their duties if he does not possess that knowledge himself? If any knotty point is brought under his notice, the only answer is—"Oh, you must do the best you can," which is certainly very good advice under the circumstances. But it often happens that before a signalman becomes acquainted with the dangers I have enumerated from his own experience, he has done immense injury, and although the mischief may not have met the eyes of the public, it enters deeply very often into the pockets of the shareholders in respect of compensation for break-downs upon the line, detention of goods, damage to rolling stock, permanent way, &c.

Officials have come round to visit me during the night to see that all was well, and report the same the next morning, who perhaps have never moved a signal or point lever in their whole railway experience; and, comparatively speaking, they scarcely know the difference between a signal and a pair of windmill sails. Suppose a signalman be taken ill, or seized with a fit while on duty, and trains are waiting to cross the junction, and a man of the above experience makes the usual call to see whether all is right, instead of being able to enter upon the duties at once, and keep the traffic going, he can do nothing, and the traffic must be kept waiting until a man is found who is competent to do the work.

Engine-Drivers and Signalmen influenced by the "Inquiry System."

This Inquiry System, which I shall presently explain, has its bearings upon a certain class of Railway Accidents, and mostly concerns engine-drivers, guards, signalmen, and foremen porters. At busy junctions it often happens that there are three or four trains, from different branches or directions, all signalled at once, and wanting to cross over the junction at the same time. It is simply impossible for the signalman to get all these trains across, and past, without detention to some of them; and a day or two afterwards he will have letters of inquiry sent to him, asking why such and such trains were detained at his "signals," in something like the following terms:—

"Superintendent's Office, _____, date _____, 7.45 p.m. Express from _____, stopped one minute at _____signal, _____. This is very serious. Let me have your full report upon this matter."

"Superintendent's Office, _____, date _____, 7.40 p.m. train to _____, nearly stopped at No. _____ signal. This is very serious. Why was it?"

"Superintendent's Office,_____, date ,
7.50 a.m. train from_____, stopped at No._____signal.
3 minutes lost. Inspector, make inquiries into this, and let me have your full report at once."

If all the superintendents upon the line had been at this junction when these detentions occurred, they could not have prevented them, yet these inquiries go on from month to month and from year to year; and to waste time and stationery upon them—particularly when they occur at busy junctions, where it is *well known that detentions cannot be avoided*—is, I think, something outrageous; it can only serve to worry the men and cause them to commit blunders. I have no hesitation in saying that the signalman often makes mistakes through being flurried, and under the dread of the above-named inquiries, as when the traffic is great he often cuts things too near to save himself from them. He has done the same thing, perhaps, many times before, and all went well; and why not try it just once again?

The same remark applies to engine-drivers, when they find a distant signal standing in the position I have previously named. The engineman has instructions to pull up his train if he is in doubt about the signal, but these "Inquiries" often influence him to chance it; and, although it is not properly at "all-right," on he goes—sooner than be blamed for losing time—and he will do this, day after day, until he meets with an accident, sooner or later. Now, the question to be answered, when trains clash together at junctions, or crossing points, under the foregoing circumstances, is—which is the quickest and safest way to get them away without delay? and who, it may also be asked, is the best able to tell: the signalman, who is on the spot, and has to deal with them daily, or his superintendent, who is, perhaps, miles away? Why do the company place the signalman there, if they have not the fullest confidence in him?

I have often thought, when I have seen express trains rushing past my box, how little the passengers know the

anxiety their trains have cost me to get them past without check or stoppage. There is very little to encourage the signalman in his difficult task, and he stands but very little chance of promotion. So long as he is able to keep all things right, the higher officials, or those in authority, hardly ever trouble to consider, that for his long and useful services, he expects a share in the promotions and appointments. I may here say, that when once a man gets out of a signal-box—either for good or bad deeds—nobody can ever get him to take to it again. A signalman may see men join the service years after him, placed in positions just under the eyes of the authorities, and promoted over his head. He wonders when his turn will come; but, alas! he hopes in vain, for, most likely, his turn is as far off as ever. In fact, he is treated like a "machine," and, so long as his "machinery" does not fail, he may stop in this responsible and trying position until his hair turns grey. I would remind the reader that signalmen have no chance of receiving any of those useful things—so much needed now-a-days—called "tips," to help them out with their scanty pay. His duties are quite heavy enough to impair the strongest of minds in a few years; and anyone has only to look at the careworn and anxious faces of the majority of signalmen to be fully convinced of this statement.

Accidents at Facing Points.

The cause of accidents at facing points is often very difficult to discover. It baffles some of the most experienced and practical men. I have been much struck by the number of different opinions on this important subject. When an accident occurs at facing points through some part of the train continuing on one line, and another part running on another until the lines widen, whereupon one or both parts are either dragged off the rails, or the couplings and chains give way, there can be to the practical mind only one opinion, viz., that the points have *shifted* during the time that the train was passing over them. The question is, how, and by what

means, has this been done? At junctions where the signals and points are worked on the interlocking system, so long as the signals are at "all-right," it is impossible for the signalman to move his points while a train is passing them; but if the signals are put to "danger" before the train is quite past the junction points, they are at liberty to be shifted, so far as the interlocking gear is concerned. Opinions differ very much (as I have remarked) as to whether facing points can be moved from the signal-box during the time that a train is passing them, so as to alter the course of some part of it after the signals have been put to "danger," but I have not the slightest hesitation myself in saying that *it can be done.* It does not altogether depend upon the distance the wheels are from each other upon the carriages, or the space that there is between the wheels of one carriage and the wheels of that following it; it is the amount of strain that the signalman is able to put upon the thin end of the point with his lever. This is very great, and constitutes all the danger there is in placing the signals at "danger" before the train has passed through the points. The rod leading from the lever is attached to the weakest part of the points, viz., about two feet from the thin ends. The length of facing points is from sixteen feet downwards; the space between the wheels upon the different classes of vehicles runs from fourteen feet downwards; and the distance between the wheels of one vehicle and those of the next one following it—measuring from that part where they rest upon the rails—is from twelve feet downwards, but this distance is increased according to the strain upon the drawbar, which depends upon the length and weight of the train in motion. The thin end of a pair of facing points can be jerked far enough open, while a train is passing over at great speed, for the wheels of any carriage to strike them on the reverse side, as soon as the wheels of the previous carriage have travelled about two-thirds the length of the points. Thus it will be seen, that in any of the above-named distances between the wheels upon a vehicle, or between the wheels of one vehicle and those of that following it, if the signals are placed at

"danger" before the whole train has passed, the facing points can be jerked open.

I very much doubt whether there would be any indication on the points to show how this had been done. Again, this movement can be more easily effected where the points have had great wear. They thus become very much weakened, and will the more readily answer the strain of the lever. The oscillation of a train passing at great speed through facing points would be in favour of my statement, for this reason: at the same instant that the jerk was given upon the lever by the signalman, the part of the train then passing the points might oscillate in the same direction as the jerk, in which case it would ease the points to a certain extent, and let them more readily answer the movement of the lever. There is one more way in which some part of a train's course may be altered during the time it is passing through facing points, and this arises chiefly from the unskilfulness or insufficient training of the signalman himself. In hot and dry weather, points require a much sharper jerk to close them than in wet sloppy weather, and if the signalman has not had this well pointed out to him while learning, it will greatly deceive him. The dust and dryness of the fittings between the points and lever will, in adverse weather, make them work very hard and stiff; and if he moves the lever over with a gradual strain, instead of with a good sharp jerk, all the "loose motion" in the fittings—which, through long wear, may become very great—will be taken up, and the points be left partly open. If a crowbar be placed in this opening, it may perhaps be possible to prise the thin end of the points nearly over to the wrong side; therefore it is possible that in bad weather, when a train is passing through facing points at a great speed, the thin end of the points may be jerked far enough open by the oscillation of the train upon the heel for some of the wheels to take them on the reverse side, because the lever in the signal box (under such circumstances) does not hold them firmly. But in such a case, I should expect to find the points strained, or the fittings injured to a certain extent.

These are the only ways in which any part of a train can be turned from its proper course when passing through facing points. I think it impossible for the flanges of the wheels to strike dead against the thin ends of a pair of points, as the ends are so very thin, that a train travelling at great speed must take them either on one side or the other. Of course a vehicle may jump off the rails at points, the same as at any other part of the line; but in that case, it would most likely jump all sorts of ways, rather than run smoothly on to some other pair of rails; therefore, when a train is divided while passing through points, it has most likely been done by the shifting of the points under one or other of the above-mentioned circumstances. I should like here to express my sense of the inestimable value of Messrs. Saxby and Farmer's great inventions in connection with points, particularly of their interlocking apparatus and locking bars.

Accidents caused through Engine-drivers not being able to see Distant Signals in Foggy Weather.

Accidents are often caused through engine-drivers being unable to see distant signals in foggy weather. Some of these signals are as much as forty feet high, or even more. How are they to be any guide to the engine-driver when he can hardly see three feet above his head? He might as well look for the "man in the moon," as try to get the faintest glimpse of a distant signal under such circumstances. What is he to do? Is he to pull his train up and wait while his fireman or the guard goes back and climbs the signal-post to ascertain how the signal is standing? Just consider for a minute the position of an engine-driver with an express train, timed to run at fifty miles an hour without stopping! how many distant signals he has to pass in that distance which he never catches the least glimpse of whatever! and how many times he has to trust to chance, sooner than lose time! He knows that if he pulls his train up to be certain about these signals, he will be severely questioned for losing time, as

some reckless driver, who is more willing to risk these dangers, will be able to keep better time; and if one man can keep good time, others are naturally expected to do the same, until they meet with a sad disaster. I have heard engine-drivers complain bitterly of their inability to see these signals in foggy weather as they pass them.

What I advise under such circumstances is this,—place another signal arm with lamp upon the post, about the same height as the driver on his engine, and let them work together. Engine-drivers would thus be enabled to see how the signals stood under any circumstances, even in cases where the lights are blown out by the wind. I would observe that all extra arms, locking bolts and bars, add additional labours to the signalman's already responsible duties; but never mind that; shorten his hours, increase his pay, and give him all the help possible in the busy seasons of the year, and he will willingly submit to any additional labour, so long as it is for the protection of the travelling public, for the safer railway travelling is made the better he is himself protected.

Accidents caused through broken Springs, Axles, and Tires.

It is an undoubted fact that many accidents are occasioned by the breaking of springs, axles, and tires of vehicles. These may be traced to the following causes—namely, violent shunting, bad joints in the rails, the great length and weight of trains, and fast travelling. I have had many opportunities of witnessing the violent manner in which shunting is often performed, and I am sure that this occasions very many railway accidents. I have seen vehicles "fly shunted" one against the other with so much violence as to cause some of them to jump off the rails, and upon such occasions the rust, or old paint, may be noticed flying from the springs or axles in clouds, showing plainly what great shocks they sustain. I have even seen springs snap clean into two parts under these

circumstances, and there must be a corresponding strain upon the axles, journals, and tires. I have seen vehicles knocked over the "stop-blocks" by the violent way in which they have been struck in shunting, and perhaps afterwards dragged twenty or thirty yards over ballast rails and sleepers by an engine to some crossing to get them on the rails again. The greatest strain must thus be put upon the springs, axles, and tires, and it seems nothing but reasonable to expect that many small fractures, unseen at the time, are caused in this way. Nothing is more likely to fracture iron than a sudden jerk or a great shock, and fractures may be hidden from the eye of the "examiner" until the part affected in time becomes very weak, and when running at great speed over badly joined parts of the road, give way, causing a break-down. Therefore the greatest care should be exercised by railway companies with regard to the usage of their rolling stock, both for their own interests and for the safety of the public at large. It appears to me that the latter are somewhat to blame in regard to this and other classes of accidents for requiring the railway companies to run trains at too great a speed. The laws of the country are also in fault for allowing railway companies to do so, and Parliament would bestow a great benefit upon the people by passing a Bill fixing the highest speed to be allowed upon any Railway at forty miles an hour. Any persons wishing to travel faster than that not only endanger their own lives, but the lives of all who travel with them. If Railway Companies are allowed to go on competing in respect of speed, there is no telling where we may find ourselves in the end.

The majority of accidents caused by fractures to machinery occur to goods trains, and this goes far to prove my statement that a great number of such fractures are caused through violent shunting. It may not be out of place here to say a few words on behalf of the men whose lot it is to perform this dangerous duty. What with the vast number of "shunts" they have to make in marshalling the trains before starting, pulling them to pieces on their arrival, the short space of time

between the arrival and departure of trains and, in most cases, the poor accommodation for such work, they have to hurry it over in the best way they can, risking their own lives, besides exposing the travelling public to the greatest dangers. Many fine hale young men are killed or maimed, their wives made widows, and their children fatherless through this dangerous employment; moreover, they are exposed to all weathers, which is very trying to the strongest constitutions. These men, therefore, deserve the greatest consideration from their employers. The only way to diminish the danger to which they are exposed, is to make better accommodation in the way of shunting room, and provide more men to do it. This would give them time to use the rolling stock with more care, and do away with much of the hurry and violence in shunting. It would save the men's lives, and save Railway Companies thousands of pounds in expenses for repairs to rolling stock, compensation for accidents, and damage to goods.

In the case of goods guards' work, I wish to point out that both the length and weight of goods trains are, generally speaking, excessive, considering the number of men and the brake power provided. A goods train consisting of between twenty and thirty waggons is often started from stations under the charge of one guard. The night may be dull and foggy, and the train may have to stop at several stations to put off and take on trucks. At some small stations the guard has everything to attend to himself, having to detach, hook on, and give signals to the engine-driver. Is it possible for one man to attend to all these things without losing time, without endangering his life, or exposing the rolling stock to great injury? When he has waggons to take on at a station, he will most likely leave his brake van and part of his train standing on the main line while he goes into the siding. Here is the danger: the engine-driver may be backing into the siding too fast, through not being able to see the guard's signal, either on account of the dullness of the night or otherwise. This will prevent the guard from going between the

waggons to catch them together; consequently, they will come into violent collision, and those he intended to attach will be knocked twenty or thirty yards along the siding, or sent crash against more waggons at the end. The engine-driver will feel the shock of this collision, and it will put him in fear of again moving his engine until the guard has traversed the whole length of the train to tell him what he wants to be done. The same thing may occur when the engine is backing with the waggons to the rest of the train left on the main line. Thus, as I have remarked, the rolling stock incurs serious injury. By the time the train is ready to start on its journey a passenger train may be due, in which case the goods will have again to shunt to allow it to pass. Perhaps it will be found that there is not room enough for the whole train to stand in the siding well clear of the main line by the length of, say, one waggon, and some minutes more will be lost in trying to make room. Probably the guard will have to divide the train, and run the first part a short distance a-head, so that it can be brought back with great force, and by this means crush the train by main force into the siding, clear of the main line. Thus more fractures may be caused to fittings in the rolling stock. While these things have been taking place the driver of the passenger train may have disregarded the signals, or the signalman may have taken it for granted that the goods train is clear of the main line; he may be in doubt of having missed seeing the guard's signal, consequently the passenger train may rush forward to find, perhaps, the engine of the goods train only half way in the siding, and foul of the main line—a collision being inevitable.

There is another great danger connected with dispatching goods trains from stations with too many vehicles. To get them in motion the drivers are often compelled to start with a sudden jerk, and many times I have seen the coupling chains snapped in two under such circumstances. With shorter trains the engine would be able to start with ease, and this would greatly lessen the danger of breaking or fracturing

the coupling chains. The same observations apply to passenger trains. Moreover, during the time passenger trains are at the stations with only one guard, delays and mishaps often occur through his being overburdened with work, such as sorting parcels, letters, &c., and attending to luggage when he ought to be looking after the flurried passengers. Passenger trains, for the safety and convenience of the public, should never be allowed to run with more than fifteen vehicles, and never with less than two guards. As a rule, and for the purpose of avoiding delays at stations, there should be one guard to every five passenger carriages.

Accidents caused through Proper Intervals of Space not being kept between Trains on the Road.

It is essential, if accidents are to be prevented, that on every railway the "absolute block system of telegraph" should be in use, so as to keep intervals of space between all trains.* It often occurs if this system is not in use, where there is a space of six or seven miles between stations, that there are two or three trains following one another at short intervals upon the same line of rails; and, under these circumstances, there is great danger of one train overtaking the other. Suppose a stopping train arrives at Station A, and is timed to shunt at Station B for a fast express to pass, and the distance between the two stations is six or seven miles, as above suggested, there may be ample time for it to run on to Station B with safety, if no mishap occurs on the way. After it has passed Station A ten minutes it will receive no further protection, as far as signals are concerned, until the signalman at Station B has become aware that it has arrived within his

* Many different kinds of Block Telegraphs have been invented. Amongst the best of those which I have seen are Messrs. Tyer and Norman's, and Harborow and Spagnoletti's. [The former's plan is used very extensively on the leading railways, and an important work will shortly be issued from the press illustrative thereof, as well as descriptive of Tyer's new Electric Interlocking Signals.—Ed. R.S.G.]

distant signal, which he will then put to "danger." Between this distant signal and Station B there may be a sharp curve, in which case the signalman will not put his distant signal to "danger" until the train has arrived in sight, if he have no other means of ascertaining that it is approaching. Therefore, the train may have passed the distant signal something like half a mile before the signal is put to "danger." Now, after it left Station A, some mishap may have occurred to the engine, thereby causing its progress to be very slow. Should the express arrive at the former station ten minutes afterwards, it will be allowed to go on with the "all-right" signal (as the signalman will consider ten minutes sufficient for the stopping train to reach Station B and shunt for the express to pass). There may be a goods train waiting to follow, either from a branch line or from a siding, which will be allowed to do so; thus there will be the stopping train, the express, and the goods train, following one another between Stations A and B. Now, in consequence of the slow speed of the first train, it may arrive in sight of the signalman at Station B just as the express is passing his distant signal, and by the time that signal is put to "danger" the express may be past it. The engine-driver, as a matter of course, rushes on at full speed round this curve, to find the station signal dead against him, and the stopping train standing at the station, or shunting into the siding for him to pass—a collision of course ensuing. Or the slow train may come to a dead stop half-way between the two stations, and before the guard has had time to go back a sufficient distance to save the express, it may be upon him, particularly if the weather should be dull or foggy. Perhaps, again, before the guard of the express, in his turn, gets far back, the goods train may smash into it. That many accidents occur under these circumstances is well known to railway companies, if not to the travelling public. Nothing but the "block" system of telegraph will prevent such accidents; and the great pressure of traffic upon our railways at the present time has made it absolutely necessary that this system should be established throughout the whole length of our

railways, boxes being placed at intervals of about two miles. That is to say, all stations under, say, three miles apart, should be worked from station to station, and where the distance is over three miles and under five, a signal-box should be erected half-way between; where the distance reaches seven miles, two signal-boxes should be so erected; and so on. By these means a safe space between all trains on the road could be maintained. Goods trains at the present time are frequently kept thirty or forty minutes at stations, waiting for fast expresses to pass, and excursion and slow passenger trains from fifteen to twenty minutes (in some cases these delays are much greater). Further, it often happens that after a goods train has been *waiting* some considerable time for an express to pass, a stopping train may arrive from a branch line, which must have precedence of this already much delayed goods train. The same thing may occur again at the next shunting station, and by the time it reaches its journey's end it may be from two to three hours late. Whereas, if the system which I have explained were in use, a goods train could leave one signal-box for another with as little as *five* minutes precedence of a fast train, and with more safety than under a system where the space between trains is regulated by time only, with *fifteen or twenty* minutes' precedence. It could easily be ascertained, by means of the single needle instrument, how far the fast train was off when the goods arrived at a shunting station. All signal-boxes should be supplied with this instrument, and the men well-instructed in their use. Moreover, at all two-mile signal-stations or boxes, there should be "cross-over roads," and good siding-room for the accommodation of trains. If, under the conditions suggested, a breakdown or stoppage of any kind took place between stations, arrangements could be made for working by "single line" in a very short time, and with but little, if any, delay to the traffic. Most junctions, I may add, are already supplied with a single-needle instrument for each double line of rails.

Accidents under the Absolute Block System of Telegraph.

From ten years experience with the absolute block system, I am prepared to say that accidents under it are rare, and what few do occur, are of a very trifling nature. They generally take place in this way:—the signalman at junction "A" signals a train on to box "B;" he goes on with his duties, having perhaps seven or eight more trains to get past in different directions. The first train may come to a dead stand between signal-boxes "A" and "B," but out of sight of them both, and when the man has another train ready to follow in the same direction, he looks at the telegraphic disc, his only guide, and finds it indicating that the line is blocked. He becomes confused; perhaps what he has been doing since the train passed has made him forget that he ought to have received a signal from "B" to the effect that the line was again "clear" until the second train is ready. He asks himself, has he received "line clear," and forgot to make the entry in his train book? or has he received the signal for the second train, and sent it on to the signalman at "B," and forgot for the moment to put his signals at "all clear" for it to pass? At the same time, signalman "B" becomes alarmed at the non-arrival of the first train. He may likewise be in doubt whether it has passed him or not, and think he has forgotten to release the key and give back "line clear" to "A." Under these circumstances, the inquiry system spoken of previously will have its effect, for both men will know that one or other of them will be called upon to answer for any delay that takes place in connection with the second train, and a fine, or the loss of his bread, may be the result. These thoughts will be quite enough to cause them to lose all confidence in themselves, particularly in the case of young signalmen. They will most likely rush to the single needle instrument; but their questions and answers being hurried and confused, one or the other will be misunderstood. Signalman "B" may come to the conclusion that the first

train has passed all-right, or signalman "A" will chance that he has signalled the first train on to "B," and forgot afterwards to put his signals to all-right. In the end, the second train is allowed to pass, coming shortly into collision with the first. Here I would point out other disadvantages under which many signalmen perform their duties, in cases where they are protecting long tunnels, as upon any of the underground Railways, or on a part of line where the view is obstructed. When a misunderstanding arises (such as I have described), the signalman has to trust entirely to memory, whereas the man in the open country, who can see from one station to another, can tell when a train is clear of the station in advance, or can see a train coming, that he might be otherwise in doubt about. This should be taken into consideration by railway authorities when mistakes occur, for, depend upon it, there is nothing gained by being too severe with good and trustworthy servants.

It, however, often occurs that men are appointed to the position of Superintendent or Station-master with no better recommendation than a few years service as clerk in the office of the General Manager or Superintendent. Men are frequently made inspectors through the influence of someone quite outside Railway management, or at the bidding of a superintendent's clerk. It is seldom that such men do a day's duty in connection with the outdoor work of the line from one year's end to another. Inspectors or station-masters appointed thus, when a "block" occurs, are like ships in a storm, on their beam ends, and the first thing they most likely essay is, appeal to the signalman or foreman-porter to know "what is the usual practice in such cases." In my opinion, the man who would make the most useful superintendent is the station-master or inspector of long standing, who has risen *from the lower grades of the service*, as a man then possesses a good knowledge of all departments of Railway work.

I have endeavoured in the foregoing writings, to the best of my humble abilities, to show how Railway Accidents occur,

and how they may be prevented. If I have been successful, and if my remarks should be productive of any good, my trouble will be abundantly rewarded.

I would also add that the majority of railway servants are most terribly overworked, as well as underpaid, which of itself constitutes a serious danger to railway travelling. This question has been agitated by railway servants all over the country for some time past, by means of meetings, and through the Press, and particularly through the medium of that useful railway journal, *The Railway Service Gazette*, which has done, and is still doing, much good for the Railway Service.

No doubt it is a difficult matter to make arrangements so as to give enginemen and guards a regular number of hours on duty each day, on account of the different distances their trains are set to run; but their hours of duty should be arranged as far as possible as follows: no engineman, passenger or goods guard, should be kept at work longer than ten hours out of twenty-four, time to be calculated from arrival (by order) at the stations to their leaving them. This would give enginemen about eight hours on their journeys, as they are generally at work the greater part of an hour before starting, and about the same length of time on arrival back. The same remarks also apply to guards' duties.

All pointsmen, signalmen and shunters should be placed on the eight hours' system; other servants in uniform should work ten hours per day; six days to constitute a week's work, and Sunday duty to be paid for as overtime. These arrangements, I think, would give satisfaction to all classes of railway servants. Extra enginemen and guards should be kept on duty at all the large stations, ready to take charge of any train of which the men in charge had been on duty this appointed time, in case it should have been delayed by bad weather, "blocks," or other causes. If the men wished to travel on to their homes, they might be allowed to do so, but they should certainly be relieved of the responsibility of working their trains.

In conclusion I would say, in the words of the second and third verses of the Thirty-ninth Psalm,—

"Before, I was dumb with silence; I held my peace, even from good; and my sorrow was stirred.

"My heart was hot within me; while I was musing the fire burned: then spake I with my tongue."

FINIS.

THE CONTINENTAL
Life Insurance Company of New York.

OFFICE—CONTINENTAL BUILDING, 22, 24, AND 26, NASSAU STREET, NEW YORK.

EUROPEAN BRANCH.
Head Office—35, Lombard Street, London, E.C.

MANAGER FOREIGN DEPARTMENT—WILLIAM C. PRESCOTT.

PURELY MUTUAL. ASSETS, £1,250,000.

SPECIAL DEPOSITS, £40,000.

THIS Company insures Lives and nothing else. It is conducted under the immediate Official supervision of the Insurance Department of the States of New York.

It is ENDORSED BY THE SPECIAL CEITIFICATE OF THE SUPERINTENDENT.

Its operations are likewise subject to, and its statements checked by, more than twenty American States and eight European Governments, to which independent verified reports and statements are made.

It is especially distinguished for its low mortality record, and its rapid relative increase of policy-holders, assets, and surplus. Especial attention is directed to the advantages this Company is able to offer in consequence of the STABLE CHARACTER OF ITS INVESTMENTS, and the great gaining power of the money invested therein.

This Company has the approval of the Prussian Government, and its "concession" for the Insurance of Prussian subjects.

ANNUITIES granted at rates from 20 to 30 per cent. better than are offered by British companies.

LIFE INSURANCE at rates below those of most British companies.

DIVIDENDS OR BONUSES declared and paid in cash each year.

Net surplus £110,000.

Dividends to policy-holders, &c., in 1871 and 1872, £330,000.

Manchester Office—96, DEANSGATE.
Glasgow Office—63, ST. VINCENT STREET.
Belfast Office—22, CASTLE PLACE.

SAXBY & FARMER'S

IMPROVED PATENT

FACING POINT LOCK

HAS THE FOLLOWING ADVANTAGES:

1st.—The Points must be properly set, *close home to the stock rail,* or the Signal for a Train to pass cannot possibly be given, and the least obstruction occurring to prevent the full and true opening or closing of the Points is at once discovered, even with connecting rods of the greatest length practicable.

2nd.—The Points are wedged firmly and immovably in the position indicated by the Signal, and the ordinary jolting and jarring occasioned by passing Trains is avoided.

3rd.—Whilst a Train is actually travelling through the Points, it is itself master of the situation; not even the Signalman can, either intentionally or inadvertently, change their position or disturb them until the whole Train is safely passed.

LONDON AND PROVINCIAL
RAILWAY SERVANTS'
United Benefit Society.

ESTABLISHED MAY 30, 1867.

THIS Society was established solely to meet a want that had long been felt by Railway Men, viz.: A Society where they could remain members after they had left the Service, as well as have a voice in the management. This is accomplished, and the attention of all classes of Railway Employés, and Members of the Amalgamated Society of Railway Servants, is hereby invited to the Benefits it pays in Sickness or Accident.

The reduced Entrance Fee and the sliding scale of payments, make it available to every one employed in the various departments of the service, who is under 40 years of age, and shuts out none who comply with its regulation. It has paid upwards of £2,500 for the relief of its members since October, 1868, which is a sufficient proof of the good it has already done, and is noted for its prompt payment of members' claims.

A Widow and Orphans' Fund has also been established, and Members can be enrolled at any of the meetings on application to the Agents. It is optional whether the members join this Fund or not. Neither do its members forfeit their privileges when they leave the service, as is the case with some of the Companies' Provident Societies.

There are various Districts in London and the Provinces, and, by its system of working, the benefits are as available to Railway men at isolated stations as if they belonged to a district, so long as they reside within the radius of any Post Office in the United Kingdom.

SCALE OF PAYMENTS AND BENEFITS.

The Entrance Fee, which varies from 1s. 6d. to 3s. 10d., has to be paid within one month from the date the candidate is proposed as a member of the Society, and he is Free to half benefits in six months, to full benefits in nine months. Medical attendance (free to all those who reside in a District) from the date of enrolment.

The weekly contributions run from 8½d. to 11½d. in the highest class, and from 4½d. to 6½d., according to age and class joined. The benefits are on the same principle, each member receiving in proportion to what he pays, the highest weekly sick pay being 20s. and the lowest 8s.; the half-pay being from 10s. to 4s., and the quarter pay from 5s. to 2s. The death allowance is from £5 to £16 for a member, and from 50s. to £8 for a member's wife.

WIDOW & ORPHANS' FUND.—FREE TO BENEFITS IN THREE YEARS.

Payments: Entrance Fee for wife 3s.; and 1s. 6d. for each child under twelve years of age; the monthly contribution for the wife is 5d. and 1½d. for each child. The benefit or allowance for the wife is 3s.; and 1s. per week for each child under twelve.

Should you wish to become a member, send one month's contribution for the Class you wish to join, with one shilling proposition fee to the Secretary, who will then give you full particulars.

New Districts can be established (or a Medical Officer appointed, if there are Eight Members at one Station) by applying to the Secretary.

The benevolent and travelling public are earnestly invited to favour this Society with their patronage and support by becoming honorary members or annual subscribers, as the dangerous nature of the occupation of railway men renders them more liable to sickness or accident than the majority of the working classes. Cheques crossed P. O. S.'s Bank or P. O. Orders payable at the General Post Office, will be thankfully received and gratefully acknowledged by the Secretary,

C. SHRIVES, 10, GROVE VILLAS,
EAST INDIA ROAD, POPLAR, E.

F. RUSSELL & CO.,

MANUFACTURERS OF

Telegraph Signal Instruments,

For Working the "Block System" on either One, Two, or Three Wires;

"REPEATERS" for showing the position of Signals, Points, or the condition of Signal Lamps at any distance.

ELECTRIC BELLS FOR DOMESTIC USE.

LIGHTNING CONDUCTORS, AND TELEGRAPH INSTRUMENTS AND STORES OF EVERY DESCRIPTION.

Telegraph Lines Erected and Maintained.

Works: — Chippenham Mews, HARROW ROAD, LONDON, W.

ARTHUR H. W. RADCLIFFE,

M.I.M.E., M.S.T.E.

7, UNION STREET, BIRMINGHAM,

Telegraph Engineer and Contractor.

Contracts entered into with Railway Companies for the Erection and Maintenance of Telegraphs, Block Signalling Apparatus, Semaphore Repeaters, and Light Indicators, &c.

Telegraph Instruments, Wire, Tools, and Stores of every description Supplied.

PRIVATE TELEGRAPH LINES ERECTED & MAINTAINED.

Collieries fitted with RADCLIFFE'S ELECTRIC SIGNALS, for Engine Planes and Shafts.

ESTIMATES FURNISHED FREE OF COST.

CHAS. PRICE & CO.'S

TRADE MARK.

PATENT RANGOON ENGINE OIL.

This Oil is suitable to every kind of Machinery; it is used almost exclusively in Her Majesty's Dockyards and Fleet, and by the War Office and East Indian Government, as well as by the Royal Mail Steam Packet Co., the Pacific Steam Navigation Co., the P. & O. Co., Cunard Co., and by most of the other important Royal Mail Steam Fleets in the Kingdom.

It is also extensively employed on the various Railways, and by many of the leading Engineering and Manufacturing Firms at home and abroad.

CHEMICAL LABORATORY,
7, PRINTING HOUSE SQUARE, BLACKFRIARS,
April, 1869.

I herewith certify that the Rangoon Engine Oil, manufactured by Messrs. Chas. Price and Co., is free from any material which can produce corrosion of the metal work of machinery. It is calculated indeed to protect metallic surfaces from oxidation, *and from its peculiar character, is not liable to lead to the spontaneous combustion of cotton, waste, or any similar material which might become imbued with it, as is the case with Rape, Gallipoli, and Olive Oils.* The lubricating power of this Oil is equal to Sperm or Lard Oil.

T. W. KEATES, F.C.S, &c. &c.
Consulting Chemist to the Board of Works.

Extract from MR. BAXTER'S *Speech in the House of Commons, May 31st*, 1870.

Chas. Price & Co.'s Rangoon Oil—"a vastly superior article (speaking of Gallipoli Oil at £72 per ton) was obtained for from £40 to £45 per Ton."

Every parcel of the Oil sent from the Works bears the Trade Mark of the Firm, and as many spurious imitations of the Rangoon Engine Oil are sold, purchasers are requested to observe that none is genuine which does not bear this Mark.

OIL, TALLOW, AND COLOUR MERCHANTS, SEED CRUSHERS, TURPENTINE DISTILLERS, ETC.

LONDON:
CASTLE BAYNARD, UPPER THAMES STREET, AND MILLWALL POPLAR.

WORKS, ERITH, KENT.

Coal Gas Made at Home,

FREE FROM
SMOKE OR SMELL.

Better in Quality, and at half the usual Cost,

By using the Improved Gas Apparatus, suitable for Villages, Mansions, **Railway Stations and for Lighting and Heating Railway Trains for long Journeys.**

For Plans, Specifications, and Estimates, "FREE OF CHARGE," apply to

HENRY SKOINES,

Inventor, Patentee & Contracting Gas Engineer,

FOR SETTING RETORTS,

Erecting or Remodelling Gas Works of any Extent at Home and Abroad.

7, ARGYLE STREET, KING'S CROSS,
LONDON, W.C.

THE TRADE supplied with the whole or any part of the Improved Gas Apparatus.

RAILWAY SIGNALS

AND

INTERLOCKING APPARATUS.

YARDLEY & CO.

BEG to call the attention of Directors, Engineers, and Superintendents to their Improved System of Signals and Interlocking Apparatus, which is now extensively used by the principal Railway Companies, and approved of by the Board of Trade Inspectors.

Plans, Estimates, and Schedules given for New Lines and Reconstructions.

RAILWAY SIGNAL WORKS,

CASTLEFIELD,

MANCHESTER.

In 8vo., price 12s.

RAILWAY REFORM.

THE PURCHASE OF THE RAILWAYS BY THE STATE CONSIDERED AS AFFECTING THE NATION, THE SHAREHOLDERS, AND THE GOVERNMENT,

WITH

A COPIOUS APPENDIX,

Containing a History of our Railway System, a Review of the Act of 1844 *authorising the Purchase of the Railways, with Extracts from the evidence given before the Parliamentary Committee which sat in that year.*

BY WILLIAM GALT.

"We cannot, however, conclude without recommending this volume to the careful notice of all shareholders and others interested in railway property. The railway system from its commencement is considered at great length, and with great perspicuity. We are shown the evils of competition, of opposition, and of high charges. It is curious to hear that the difference to the shareholders between a very high and a very low tariff is very small, but there is a mean rate which has to be arrived at by experience, that produces the greatest dividend."—*The Daily News.*

LONDON: LONGMAN & CO.

RAILWAY TRAIN INTERCOMMUNICATION

Between Passengers and Guards and Engine Drivers.

Col. Binney's Electric System

IS THE MOST EFFICIENT YET INTRODUCED AT A REASONABLE COST,

And the one most approved by Board of Trade Inspectors.

For Particulars apply at the Office of the Lubricative Packing Company, 5, Hackney Road, E., or to S. J. Mackie, Esq., C.E., 3, Delahay Street, Westminster, S.W.

Railway Signals & Locking Apparatus.

EASTERBROOK, HANNAFORD & CO.,

THE ORIGINAL PATENTEES AND OWNERS OF THE CATCH-ROD LOCKING APPARATUS,

3a, Finsbury Place South, London; Ironworks, Bridgewater; and Crumlin Viaduct Works, Newport, Mon.,

Beg to call the attention of Directors, Engineers, and Superintendents, to their Patent Catch-rod Locking, now largely introduced on the Great Northern, North Eastern, Great Western Railways, and other main lines in Europe and India, and admitted by the Board of Trade Inspectors to be the most efficient locking ever introduced on the Railway systems.

J. R. MACONOCHIE,

NORTHWICH,

SUPPLIES TO ANY STATION, PORT, OR PLACE

ROOFING SLATES

Of every colour, kind and size for plain and ornamental roofing.

SLATE SLABS

Up to twenty feet long; Billiard Table Beds, Large Cisterns, Lavatory Fittings, Urinals, &c., and every description of Slate Slab work at little more than half usual cost.

PORTLAND CEMENT,

Specially adapted for Engineering and other important work, standing double the test required by the Metropolitan Board of Works, and being the strongest cement known.

Roman and other natural Cements, Blue Lias, Lime, &c.

BUILDING AND PAVING BRICKS,

Red, White, Blue, and Brown, to any pattern; Roofing Tiles, Wall, &c., Coping, Garden Edgings, &c. &c.

A Million ordinary Bricks can be loaded up at a few days' notice.

STOURBRIDGE AND OTHER FIRE BRICKS,

Made from Selected Clays, suitable for Chemical Works, Blast and Puddling Furnaces, Boiler Seatings, Flue Covers, &c.

GLAZED SOCKETTED DRAIN PIPES,

From 2-in. to 30-in. bore.

INDIA RUBBER

Belting, Tubing, Wheel Tyers, Buffers, Springs, Washers, Packing Rings, Mats, &c., &c.

RAILWAY FASTENINGS,

Nuts, Bolts, Spikes, Rivets, Washers, &c.

Improved Patent Wrought Nails, Roofing and Boiler Felt, Pitch, &c. &c.

ESTIMATES FORWARDED ON APPLICATION.

McKENZIE, CLUNES & HOLLAND,

VULCAN WORKS, WORCESTER,

Railway Signal Engineers, &c.

(Established 1860).

Patentees and Sole Manufacturers of Improved Junction Locking Apparatus,

Which has given great satisfaction, and is highly approved by the Inspecting Officers of the Board of Trade; they have fixed Signals and Patent Interlocking Apparatus upon the following Railways:—

Aberystwyth and Welsh Coast.
Brecon and Merthyr.
Bristol and North Somerset.
Cambrian.
Carnarvonshire.
Central Wales.
Central Wales Extension.
Corwen and Bala.
Dingwall and Skye.
Dowlais Extension.
Enniskillen and Bundoran.
Fermoy and Lismore.
Ffestiniog and Blaneau.
Great Eastern.
Great Western.
Great Western and London and North Western Joint Railways.
Hereford, Hay, and Brecon.
Hexham and Allendale.
Llangollen and Corwen.
Llanrwst.
Llynvi and Ogmore.
Macclesfield, Bollington and Marple.
Merrybent and Darlington.
Monmouthshire Railway and Canal.
Much, Wenlock, and Craven Arms Extension.
Nantwich and Market Drayton.
Neath and Brecon.
Neath and Brecon, and Swansea Vale.
Newport, Abergavenny, and Hereford.
Newport Pagnell.
North Eastern.
North Staffordshire.
Oswestry, Ellesmere, and Whitchurch.
Potteries, Shrewsbury, and North Wales.
Salisbury and Dorset.
Solway Junction.
Stafford and Uttoxeter.
Stourbridge.
Stourbridge Extension.
Swansea Vale.
Tenbury and Bewdley.
Thetford and Watton.
Wellington and Market Drayton.
West Midland.
Worcester and Hereford.
Worcester Railways.
&c. &c. &c. &c.

McK. C. & H. would beg to call attention to their many recent improvements in Locking and Signalling, which have been specially designed with the view to reduce the Cost, and at the same time give the greatest efficiency, combined with simplicity and ease of working.

Schemes and Plans Prepared, comprising all the latest known requirements in Signalling and Interlocking.

The Midland Wagon Company,

MIDLAND WORKS, BIRMINGHAM.

Manufacturers of Railway Carriages.

WAGGONS OF EVERY DESCRIPTION FOR CASH,

Deferred Payment over a series of Years, or on Hire.

Repairs, by Contract or otherwise, undertaken in every District.

Second-hand Coal, Coke, and Ironstone Wagons, for Sale or Hire, including Repairs.

D. N. ARNOLD, *Manager.*
E. JACKSON, *Secretary.*

RAILWAY JUNCTION SIGNALS.

Points and Signals Interlocking Apparatus.

COURTNEY, STEPHENS & BAILEY,

Having had most extensive experience in the erection of above, beg to direct attention to their Improved System which has given universal satisfaction, and in every instance been approved by the Board of Trade Officers.

ENGINEERING WORKS:—

Blackhall Place Iron Works,

DUBLIN.

ROBERT KEARSLEY,

RIPON,

MANUFACTURER OF VARNISHES

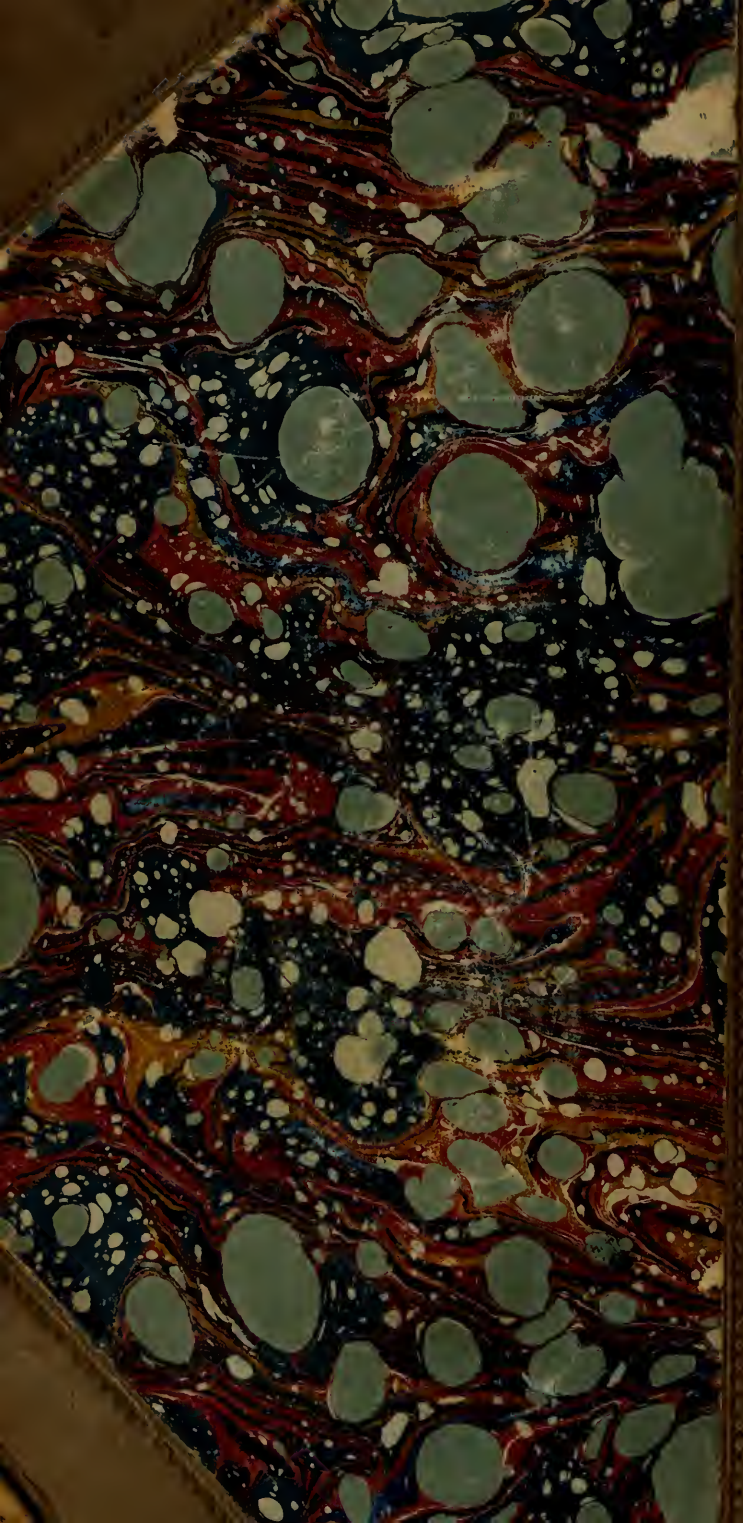
FOR THE USE OF

Railway Companies, Coach Builders and Decorators;

JAPANS, LACQUERS, OIL PAINTS, PATENT DRYERS, LAKES,

AND ALL FINE COLOURS.

ESTABLISHED 1839.

OIL REFINER AND BOILER,

Drysalter, etc.